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#### VOLUME CHANGES IN CAST IRON DURING CASTING

The bureau, in cooperation with the American Foundrymen's Association, has recently made a study of methods for determining volume changes in metals during casting. A knowledge of the magnitude of these volume changes is considered essential to good foundry practice in order to produce sound casting economically.

A method was developed, applicable to cast irons as well as to nonferrous metals, which permits determination of the shrinkage undergone by the metal from a temperature in the liquid state to room temperature.

The application of this method under actual foundry conditions is too involved and time consuming. Consequently, an indirect method, based upon data obtained on 12 cast irons, has been devised by means of which it is believed the volume changes occurring in cast irons during casting can be quickly determined in the foundry and with sufficient accuracy for all practical purposes.

The total amount of impurities and the linear contraction of the cast iron in cooling from the freezing temperature to room temperature are all that need be determined in the foundry.

The volume changes that take place while cooling in the liquid state, dur-

ing solidification, and upon further cooling, to room temperature are calculated from these data and from three charts, the derivation of which was described in a recent Bureau of Standards' publication.

#### MECHANICAL PROPERTIES OF WHITE-METAL BEARING ALLOYS AT DIFFERENT TEMPERATURES

The usual white-metal bearing alloys require tin or antimony or both as essential constituents. Both tin and antimony are so-called "strategic" metals and the potential military demands for these metals are considerable. These facts were responsible for the sponsoring by the War Department of recent studies at the bureau aimed toward the reduction or possible elimination of the amounts of tin and antimony needed for bearings.

One phase of this work was a study of the wear resistance and other mechanical properties of 10 white-metal bearing alloys. The alloys tested included 2 tin-base and 7 lead-base alloys and 1 alloy of cadmium and zinc.

Each of the properties, with the exception of wear, was determined at several temperatures ranging from 20° to 200° C. (68° to 390° F.), since it is in reality the properties at the higher

temperatures that play the major part in determining the success or failure of a bearing metal under service conditions. Resistance to wear was determined only at 20° C. No one of the alloys considered was found to excel in all of the mechanical properties studied. Thus, the tin-base alloys showed higher resistance to wear and in most cases had higher Izod impact values, at each temperature of test, than the lead-base alloys, but in most cases showed lower resistance to pounding than the lead-base and cadmium-zinc alloys. The hardness numbers and compressive properties of the tin-base alloys were found to be lower than those for the alkaline-metal hardened lead and the cadmium-zinc alloys. The alkaline metals used for hardening lead were calcium and barium. The mechanical properties of the lead-antimony-tin alloys, in most cases, were higher as the tin content was increased.

Crankshaft bearings of four compositions were prepared for service tests in United States Army class B trucks. These compositions consisted of two tin-base and two lead-base alloys. The results of these tests indicated that the tin-base alloys were superior in their wear resistance to the lead-base alloys. These results were consistent with those obtained on wear in the laboratory tests.

#### FACTORS AFFECTING THE PHYSICAL PROPERTIES OF CAST RED BRASS

In 1929, when the special committee of the American Society for Testing Materials on promotion of general use of specifications for copper alloys in ingot form made a survey of the industrial field, it was found that 600 copper-base alloy compositions were then in use that might be grouped into 20 classes. Simplification in industry inspired the hope that eventually each class might be represented by one composition.

The Non-Ferrous Ingot Metal Institute agreed to sponsor an investigation at the bureau under the research associate plan. The purpose of the investigation was to obtain data upon which to base further work of bringing about agreement upon an optimum number of typical compositions of copper-base ingot metal and to develop equitable standard specifications for the different classes.

The advisory committee of the institute suggested that as red brass of the nominal composition of 85 per cent copper and 5 per cent each of zinc, tin, and lead is one of the most widely used

copper-base commercial alloys it should be the first alloy investigated. As it was recognized that no particular type of test bar is now accepted as standard by industry, several distinct types were selected to be compared. The effect of pouring temperature and the influence of the use of virgin metal or remelted metal were other factors to be studied.

The tensile strength, Brinell hardness, electrical resistivity, and density were determined for various types of test bars cast at temperatures ranging from 1,900° to 2,300° F. The maximum values were obtained for the test bars cut from the chill ingot, and pouring temperature had little influence on these results. Somewhat lower values were obtained for the test bar obtained by the immersion in the molten metal of a graphite shell. Lower values were obtained for the sand-cast test bars. For the latter it was found that a pouring temperature above 2,200° F. had a pronounced influence on the physical properties.

A study of the metallographic structure of the test bars poured at high temperatures indicated that the marked columnar structure formed under such conditions is accompanied by inferior physical properties.

Microscopic examination of the same bars showed markings due to strain or deformation in the sand-cast bars that were absent in the bar from the immersion crucible. To this was attributed the difference in physical properties at the high temperatures.

The alloy made from remelted metal was found to be somewhat more fluid than from virgin metal cast under the same conditions. The shrinkage of the alloy from the highest pouring temperature to room temperature was determined. It was noted that the alloy expands slightly immediately after solidification, after which it contracts at a uniform rate to room temperature.

#### CORRELATION OF SOME MECHANICAL AND MAGNETIC PROPERTIES OF 1.31 PER CENT CARBON TOOL STEEL

This investigation was undertaken by the Cleveland Twist Drill Co. in cooperation with the Bureau of Standards, with the idea of minimizing, so far as possible, variables due to complex composition, and difficulties heretofore encountered in the mechanical testing of hardened steel. The material chosen was a simple carbon tool steel and the tests followed a mechanical method which has proved especially suitable for this class of mate-

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rial. In this way it was hoped that some clue might be obtained as to the fundamental relationships between the magnetic and mechanical properties.

Magnetic and mechanical tests were made on a series of specimens subjected to various heat treatments intended to cover the range commonly regarded as useful for this steel, with some overlapping beyond the regions of usefulness.

An important conclusion drawn from the results is that each property determined has its own individuality, distinct from that of the other properties. Relationships between the several properties are not always obvious, and when they do appear to exist it may be for only a limited range of heat treatments. This behavior indicates that the changes taking place in the constitution of the steel during the heat treatments examined are very complex in their nature.

It should not be concluded that magnetic analysis is of no value, but only that it should be applied with a full knowledge of the limitations of the method and within the range in which correspondence is known to exist.

The complete report of this work will be presented in a paper by J. V. Emons, of the Cleveland Twist Drill Co., and R. L. Sanford, of the Bureau of Standards, at the June meeting of the American Society for Testing Materials.

#### ELECTRICAL CONDUCTANCE OF NON-METALLIC PIPE COATINGS

The electrical conductance of pipe coatings is recognized as an important factor in the study of protective coatings. Because of the very wide range in conductances encountered it is difficult to find a simple and universally applicable method of test suitable for field use. Resistances of the order of megohms are frequently encountered, which precludes the use of the a. c. bridge with induction coil and telephone receiver. On thin coatings, capacity effects are noticeable when using a periodically reversed current, and where the resistance is very high, the error introduced by this effect may be large.

Errors involved in the measurement of conductance by the use of direct-current apparatus include: (1) Polarization; (2) galvanic potentials between the pipe and the auxiliary electrode, called the saddle; and (3) endosmose, or the movement of moisture within the capillary pores of the coating. Polarization errors are found to be relatively small if the pipe is

made anodic during the measurement. Galvanic potentials between the pipe and the saddle may be as high as 0.3 volt, even though an iron saddle is used. Errors from this effect may be kept within limits considered satisfactory for this class of work, if a potential difference of at least 3 volts is applied across the coating under test. A potential difference of 30 volts is sometimes found to give variable and erratic results when testing coating conductances. This is attributed to endosmose, or the movement of the liquid in the direction of current flow, within the pores of the coating.

With these various difficulties in mind, a simple and portable direct-current test set has been assembled by E. R. Shepard, of the bureau, which measures coating conductances with an accuracy considered satisfactory for that class of work. It includes two current-indicating instruments in series with a 3-volt dry battery. A number of ranges corresponding to currents of 4.5 microamperes to 0.45 amperes are obtained by a combination of shunts. For the lower resistances a Weston milliammeter is used which can be read immediately after closing the circuit and before polarization appreciably diminishes the deflection. For the higher resistances a microammeter is employed, the relatively long period of which is not objectionable, as polarization effects are not serious at low-current densities. For extremely high resistances, a 30-volt battery is provided.

Comparative tests on a large number of sample pipe coatings in soil boxes indicate that this d. c. test set, when properly used, can be relied upon to give results within about 15 per cent of those obtained with an a. c. bridge. Because of the variable and unstable character of coating resistances, this accuracy is considered satisfactory.

The full report of this work will be published in the pipe-line number of the Oil and Gas Journal (June 9, 1932) and the June number of the American Gas Journal.

#### MEETING OF THE AMERICAN PHYSICAL SOCIETY

The one hundred and seventy-seventh meeting of the American Physical Society was held in Washington April 28 to 30, inclusive. Sessions on the first two days were held at the Bureau of Standards and on the last day at the National Academy of Sciences.

The following papers were presented by members of the bureau's staff. The numbers are those by which the papers were designated on the program.

(1) The Mechanism of Atomization Accompanying Solid Injection, by R. A. Castleman, jr.

(55) Infra-red Spectra of the Noble Gases, W. F. Meggers and C. J. Humphreys.

(64) Electron Temperatures and the Concentration of Excited Atoms in a Cesium Positive Column, by F. L. Mohler.

(66) Polarization of Radiation from Metals Bombarded by Slow Electrons, by C. Boeckner.

(112) A Method of Measuring the Short-time d. c. Conductivity of Insulating Liquids, by G. W. Gardiner, jr.

#### GRAPHICAL DETERMINATION OF POLAR PATTERNS OF DIRECTIONAL ANTENNA SYSTEMS

In Research Paper No. 435, which will be published in the May number of the BUREAU OF STANDARDS JOURNAL OF RESEARCH, graphical methods are applied to the determination of directive patterns of antenna arrays which are made up of half-wave or doublet elements. The elements are assumed to be parallel to each other with their mid-points lying in a common plane. This makes it possible to consider them as point sources lying in that plane, provided that in planes parallel to the elements, the directive results so obtained are modified by the cosine law.

The array is drawn to a convenient wave-length scale so that retardations or path differences in any direction from the array may be easily determined for each element. Then at a distant point *P* the effect of the radiated energy from each element is represented as a vector whose magnitude is a function of the current in its corresponding element, and whose phase angle is determined by the sum of the path difference expressed in degrees and the phase angle of the current in the element. The resultant of this vector diagram is the relative magnitude of the radiation in the direction of the point for which the diagram was drawn. From a number of such diagrams taken for points in different directions and equidistant from the array, the radiation characteristic may be plotted either in polar or Cartesian coordinates.

In order to facilitate the construction of the vector diagrams a special

protractor was developed, carrying the scales for the conversion of path differences to phase angles, as well as a circular protractor, one half of which is used for finding the retardation phase angles determined by conversion scales, and the other half for the inclusion of phase differences between the currents in the antennas of the array.

As illustrations of the method, detailed descriptions are given of the steps necessary in determining the patterns of two simple arrays, one a broadside array and the other an end-on array, each comprising two antennas.

By a very simple extension of the method, the directive patterns of groups of antennas may be combined, thus simplifying materially the labor involved in the constructions for a large array. This method may also be applied to an array and its image in the earth. A graphical multiplying chart simplifies the calculation of the image currents. By means of another similar chart the directive effect of a single half-wave antenna may be included in the construction to give the directional characteristics of an array in a plane containing the antennas.

#### LINEAR THERMAL EXPANSION OF MUSCOVITE MICA

The total linear thermal expansion of preheated muscovite mica from room temperature to 900° C., the maximum temperature reached, was found to be 0.73 per cent, resulting in a coefficient of  $8.3 \times 10^{-6}$ . The rate of expansion was unusually uniform throughout the entire range. In order to obtain a specimen for this study it was necessary to preheat the mica to approximately 1,225° C. The light, flaky appearance of mica was no longer evident after this treatment. The P. C. E. (softening point) also made on the preheated material, was 14, equivalent under the conditions of the test, to 1,400° C. Petrographic examination showed the original material to be almost entirely free from impurities.

#### STATICAL HYSTERESIS AND FLEXURAL STRESS IN A FREELY VIBRATING U BAR

To be of use in instruments, elastic elements, such as springs and diaphragms, should be perfectly elastic; that is, a given loading should give a constant value of the deformation under the ordinary conditions of use. However, the deformation varies with change in temperature of the spring, the rate at which the load is applied,

the length of time of its application, and the previous conditions of load and time to which the elastic body has been subjected. The effects not depending upon temperature are sometimes called elastic defects. One of these defects, all of which are of importance to instrument designers, is the subject of Research Paper No. 443 which will be published in the May number of the Bureau of Standards Journal of Research.

In general, the cyclic deformation of an elastic body is associated with an appreciable loss of energy. If this energy loss is independent of the time taken in making the load cycle, it is defined as being due entirely to static hysteresis. One of the methods used in the study of this phenomena, the static method, consists in subjecting the deformable body, for example, a clamped bar, to a load cycle in which the load is slowly varied, and noting the hysteresis or the excess of the deformation for the decreasing load over that for the increasing load. This method, however, is time consuming and requires extreme care to secure sufficient accuracy. Another, is the dynamical method which consists of observing the rate of dying down of the free vibration of the body. This method is quicker and easier and is therefore preferable, if it can be shown that the results obtained by it are equivalent to those obtained in the first method.

To investigate the reliability of the dynamic method the hysteresis of an Armco iron U bar was determined experimentally by both methods. The experiments by the static method consisted of two series: In one, the load range was kept constant, and the effective length of the bar varied; in the other, the effective length was kept constant and the load range varied. In the dynamical method the manner of supporting the fork was also varied since this was expected to influence the results. The results of the experiments showed that within the limits of accuracy of the approximate theory used, both methods gave equivalent results.

For stresses above a certain small threshold value, it was found that in Armco iron the energy lost by static hysteresis varied approximately as the cube of the amplitude of the maximum stress.

#### PERMANENT RECORD PAPER

A group of commercial permanent record papers recently tested by the bureau gave evidence that manufac-

turers are applying the results of research on permanence qualities. The nine papers tested were of bond type and were made from rag fibers by five different manufacturers. The samples far exceeded the average quality previously found in such papers by the bureau.

The papers were exceedingly strong, the folding endurance ranging from 2,300 to 11,000, and the strength was stable, the retention of folding endurance under the heat test (exposure for 72 hours to 100° C.) ranging from 75 to 100 per cent. This excellent stability is attributed to the high cellulose purity and the low contents of rosin and acid, all of which are evidence of careful control of the paper-making operations.

The purity of the cellulose is shown by the high content of alpha cellulose, 93 to 98 per cent, and the low copper number, 0.33 to 0.83. When subjected to the heat test, the alpha cellulose did not decrease at all in four of the papers; these same papers did not gain in copper number, while for all the papers the maximum loss in alpha cellulose was 1.7, and the maximum increase in copper number was 0.45. The rosin content was not more than 0.2 per cent in four of the papers, and the most found was 1.8 per cent. Two of the papers contained no acid, and the maximum acidity was 0.05 per cent. The average weight of the papers was 68 pounds (per 500 sheets, 25 by 40 inches), and they were all surface sized with animal glue.

Papers such as these, if stored under favorable conditions, should endure indefinitely.

#### CINDER AGGREGATES FOR CONCRETE BUILDING UNITS

In cooperation with the National Building Units Corporation a study has been made of the physical characteristics of cinders used as aggregate in the manufacture of cinder-concrete building units.

Fifty-seven different kinds of coal cinders, forty-four of bituminous origin, nine of anthracite origin, and four of both mixed, were obtained from forty-seven manufacturers throughout the country. These cinders were the products of high-temperature combustion under forced draft. The samples received were from the regular run of such aggregate crushed to size.

Tests for weight, hardness, ignition loss, grading, and soundness have been made. Determinations of the weight per cubic foot of the dry rodded ma-



terials were made in accordance with the methods of A. S. T. M. Standard C29-27. The weights of the bituminous cinders ranged from 45 to 77 lbs./ft.<sup>3</sup>, the average being 57. The average weight of the anthracite cinders was 57 lbs./ft.<sup>3</sup>, individual samples ranging from 52 to 63 pounds. For the mixed cinders the average weight was 57 lbs./ft.<sup>3</sup>, the maximum and minimum values being respectively 54 and 65 pounds.

The hardness tests were intended to give measures of the resistance of the cinders to impact and abrasion. The portions of the cinders that were too coarse to pass a No. 8 sieve were placed in a ball mill of definite size and shape and containing a definite number of flint balls of uniform size. The mill was rotated at a constant velocity for a fixed time. The percentage of the original sample then retained on the No. 8 sieve was taken as a measure of the hardness. With the bituminous cinders this measure of hardness ranged from 17 to 65 per cent, with an average of 36. The anthracite cinders gave values ranging from 2 to 14 per cent with an average of 7, and the values for the mixed cinders ranged from 16 to 22 per cent with an average of 20.

The ignition loss gave the total combustible content in the sample, including a slight amount of water absorbed by the material after being dried. For the bituminous cinders the average loss by weight was 27 per cent with a maximum of 57 and a minimum of 7 per cent; for the anthracite cinders the average was 35, the maximum 46, and the minimum 26 per cent.

Grading separations were made on the  $\frac{3}{4}$ -inch,  $\frac{5}{8}$ -inch, Nos. 4, 8, 16, 30, 50, and 100 sieves. In only a few instances were any particles retained on the  $\frac{3}{4}$ -inch sieve and at the most only 3 per cent of the total weight. Three-eighths inch usually was the maximum size. The amounts retained on the  $\frac{1}{4}$ -inch sieve were as follows: Bituminous cinders, average 34, maximum 65, minimum 12 per cent; anthracite cinders, average 19, maximum 30, minimum 6 per cent; mixed cinders, average 27, maximum 34, minimum 17 per cent. The fineness moduli (the summation of the cumulative percentages retained, divided by 100) were: Bituminous cinders, average 4.1, maximum 5.4, minimum 2.9; anthracite cinders, average 3.9, maximum 4.3, minimum 3.2; mixed cinders, average 4.0, maximum 4.4, minimum 3.4.

The soundness tests were made in accordance with a method devised by

the Building Research Board in England. A 3-inch diameter pat,  $\frac{1}{4}$ -inch high, was formed on a glass plate from a 1:3 mix by volume of a cementing mixture (equal parts by weight of Portland cement and plaster of Paris) and pulverized clinder. After three hours storage in moist air the pat was placed under water. Unsoundness was detected by cracking or curling of the edges of the pat within four days. All of the 57 cinders were classified as sound by this test.

#### MODULUS OF RUPTURE OF TYPICAL AMERICAN KAOLINS

The Columbus branch of the bureau has been testing typical American kaolins from the largest producing areas. The following table is a résumé of the modulus of rupture determinations on these clays at the various conditions.

Kaolin designation	Modulus of rupture (in lbs./in. <sup>2</sup> )					
	Dry	Cone 5	Cone 8	Cone 11	Cone 14	Cone 18
North Carolina (S)	77	1,094	1,345	1,552	2,305	2,367
South Carolina (T)	33	148	283	646	439	516
Georgia (U)	72	95	292	348	587	640
Georgia (V)	16	139	131	533	621	785
Georgia (W)	32	309	298	892	474	1,100
Florida (X)	229	517	784	730	1,352	1,583
Florida (Y)	267	453	561	936	1,175	980

NOTE.—The above cones are approximate, there being 1 to 2 cones variation depending on conditions.

The bars used in this investigation were made by extrusion from an auger brick machine, being cut by wire from the center of a standard  $2\frac{1}{2}$  by  $4\frac{1}{2}$  inch brick column. Thus it was hoped to eliminate surface skin effect. The clay was previously aged for 48 hours and pugged three times.

The results are not to be taken as precise values because of the apparent relative difficulties encountered in working kaolins for the production of pure clay bars. Warpage, kiln cracking, lamination, and dunting were encountered to some degree in all cases.

#### FIRE PROTECTION OF VALUABLE RECORDS

The following is an abstract of a paper presented by S. H. Ingberg, chief of the fire resistance section of the Bureau of Standards, before the Fifth All-Ohio Safety Congress at Columbus, Ohio, April 21, 1932.

The vital importance of records is often not appreciated until loss, such as by fire, occurs. Other things of greater apparent intrinsic worth may receive more thought and care as regards methods of handling and safe disposition. Yet on the fact of preservation or loss of records in a destructive fire may depend the decision as to whether or not the establishment will be rebuilt and its business resumed. The high mortality of firms suffering disastrous fires can be traced in many instances to the loss of records forming the basis of tangible and intangible assets.

Other property and human values are also involved. Scattered throughout the length and breadth of the land, and indifferently protected, are the public records of birth, marriage, and death, deeds of conveyance and trust, testaments, court decrees, and the multitude of written evidence on which proof of citizenship, legal status, rights, and ownership depend. The loss of these records may mean expensive litigation and deprivation of rights and property that have required a lifetime of effort and sacrifice. Fire is an ever-present menace and is no respecter of persons or classes of property. Its toll for the country as a whole can be predicted within limits from year to year, and the only recourse by which the hazard for a given location or property can be reduced below that of the average is by the application of prevention and protection measures of proven effectiveness.

From the standpoint of value, records have been classified as vital, important, useful, and nonessential. Vital records are those underlying the organization of an establishment and those giving direct evidence of legal status, ownership, accounts receivable, and incurred obligations. Important records, while not irreplaceable, can be reproduced from original sources only at considerable expense. The loss of records classed as useful would cause temporary inconvenience, but otherwise entail no serious permanent disadvantage. Nonessential records are those that have no present value and should be destroyed. While some important records increase in value with age, most classes decrease in usefulness with time, which serves to place them successively in lower value classifications.

That records have money value is demonstrated by the very considerable expense that is being incurred for their protection. The value of some records

can be definitely appraised in terms of the labor and material cost of their replacement. Other records have what has been termed consequential value which is stated in terms of the loss that would be sustained in their absence, records covering accounts receivable being an example.

The evaluation of the records of an establishment may lead to surprising results. As an example, an informal appraisal of the value of the property of the bureaus in the Department of Commerce gave the following results:

Value of buildings---	\$25,387,000
Inventory values of contents-----	10,875,000
Records and other uninventoried values-----	189,948,000

It is thus seen that uninventoried values, which pertain almost wholly to records, constituted over 80 per cent of the total appraised value.

The length of time records should be retained is a matter that requires study for each establishment. Such study over a period of years should enable a consistent schedule of retention of useful records and destruction of those no longer useful to be established. Generally, those in the higher value classifications would be retained permanently or for longer periods than the others. However, there are many exceptions to this rule. For some establishments legal limitations, such as statutes of limitations and the requirements of State or Federal regulatory bodies as, for instance the Interstate Commerce Commission, will govern the period of retention. A great many records are, however, eligible for destruction soon after they originate. As an example, one large organization found that approximately 30 per cent of all its correspondence may be destroyed at once or within one month after the date of origin. Further suggestions on retention periods for different types of records are contained in schedules, such as those published by the National Fire Protection Association, the National Electric Light Association, and for some types of public-utility companies, by the Interstate Commerce Commission.

The hazard of loss by fire can be decreased in varying degree by the application of measures designed to prevent the occurrence of fire, to protect records of value from destruction in case fire occurs, and by storing duplicates in a place where they would not

be subject to loss by a fire that would affect the original record.

Very much can be done to decrease the fire hazard to record storage by observing well-recognized general principles of fire prevention and protection. This may attain a degree where further protection would not be required except possibly for the most vital records. If the records are housed in a fire-resistive building with a minimum amount of interior and exterior combustible trim, with openings well protected against exposure fires, and with interior vertical and horizontal openings protected so that fire will not be communicated, a high degree of protection can be attained by the use of suitable equipment for housing the records. Such equipment should be of incombustible material with compartments as small as is consistent with the type of record and the office routine. Six-sided inclosures, such as filing cabinets and closed shelves, are preferable. If these are placed on an incombustible floor finish and care is taken to avoid accumulations of unshelved or unfiled combustibles within the room, the possibility of a fire involving more than at the most a few containers or compartments is quite remote. In nonfire resistive buildings such protection can not be premised, since a general building collapse may occur from a fire anywhere within the building. General fire protection equipment, such as automatic sprinklers, effects a decided improvement under the latter conditions, since fires are then checked in their initial stage. The possible water damage to records is generally over estimated considering that their main value depends upon legibility. General protection measures, such as those outlined above, are the only ones feasible where a large volume of records is involved. Specific buildings erected and equipped for the purpose are preferable, although good protection can be obtained in segregated portions of ordinary fire resistive buildings conforming with the structural and finish requirements above outlined.

Where structural or other conditions are unfavorable, and possibly under all conditions for very important records, further protection should be obtained by recourse to such means as record vaults and portable record containers. The walls and doors of vaults should have sufficient fire resistance and strength to withstand the fire exposures and impacts to which

they may be subjected in the given location.

While the volume of records that can be profitably stored in insulated portable containers, such as safes, is limited and under some conditions the protection can not be definitely predicted, this type of device is an important factor in record protection. The advantages consist in being able to place the container where the contents will be the most readily available. While the volume that can be thus protected profitably is limited, it will generally be found that a small percentage of the volume of records constitutes a very high percentage of the total value, and this portion, if protected, will afford a substantial assurance against serious loss.

One suggestion relative to the handling of charred or partly charred records may be pertinent. The filing cabinets or other containers should be left as far as possible in their original location and the contents of each drawer or compartment extinguished with a minimum amount of water. If this precaution is observed it may be possible to reconstruct a partly charred file of records where it would be totally lost if taken out of its place or container. Charred records can frequently be read by eye due to the different color of the char under the writing.

The unnecessary retention of records that have served their useful purpose involves expense for equipment and storage space and also makes the really useful records less available. Frequently such records will be stored in locations and containers that will introduce a decided fire hazard to the building and its more valuable contents. A schedule for the retention of records should be supplemented with a coordinated program of destruction of those that have reached the limit of their useful period. This can best be accomplished by classifying records when they originate and providing means for destroying those that are deemed useless after a certain period. Where records of a given class originate in large volume, they may be placed in separate files and marked for permanent retention, retention over a period of years, or destruction within a comparatively short period. By this means the contents of the containers can be destroyed at given intervals without requiring sorting of the contents.



**NEW AND REVISED PUBLICATIONS  
ISSUED DURING APRIL, 1932**

**Journal of Research<sup>1</sup>**

Bureau of Standards Journal of Research, vol. 8, No. 3, March, 1932 (RP Nos. 416 to 426, inclusive). Price, 40 cents. Obtainable by subscription.

Bureau of Standards Journal of Research, vol. 8, No. 4, April, 1932 (RP Nos. 427 to 433, inclusive). Price, 40 cents. Obtainable by subscription.

**Research Papers<sup>1</sup>**

(Reprints from Journal of Research)

RP401. Effect of casting temperatures and of additions of iron on bearing bronze; C. E. Eggenschwiler. Price, 10 cents.

RP405. The heats of combustion of methyl and ethyl alcohols; F. D. Rossini. Price, 10 cents.

**Simplified Practice Recommendations<sup>1</sup>**

SPR65-31. Packaging of overhead electric railway material. Price, 5 cents.

SPR107-31. Glassine bags. Price, 5 cents.

SPR123-30. Carbonate beverage bottles. Price, 10 cents.

**Commercial Standards<sup>1</sup>**

CS33-32. Knit underwear. Price, 15 cents.

**Miscellaneous Publications<sup>1</sup>**

M130. National directory of commodity specifications (cloth bound). Price, \$1.75.

M133. Standards Yearbook for 1932 (cloth bound), Price \$1.

M134. Visitors' manual of the Bureau of Standards. Free upon application to the bureau.

M136. Bibliography on standardization. Price 5 cents.

**Commercial Standards Monthly<sup>1</sup>**

Commercial Standards Monthly, vol. 8, No. 10, April, 1932. Price 10 cents. Obtainable by subscription.

<sup>1</sup> Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 25 cents per year (United States and its possessions, Canada, Cuba, Mexico, Newfoundland, and Republic of Panama); other countries, 40 cents. Subscription to Journal of Research, \$3 per year; other countries, \$3.75. Subscription to Commercial Standards Monthly, \$1 per year; other countries, \$1.25.

**Technical News Bulletin<sup>2</sup>**

Technical News Bulletin No. 180, April, 1932. Price 5 cents. Obtainable by subscription.

**LETTER CIRCULARS<sup>2</sup>**

LC322. List of publications of interest to household purchasers.

LC323. Standards and specifications for building materials.

LC324. Brake-testing devices.

LC325. Aeronautical publications by members of the staff of the Bureau of Standards. (Supersedes LC285.)

LC326. Sound absorption coefficients of the more common materials. (Supersedes LC308.)

LC327. Cellophane.

**OUTSIDE PUBLICATIONS<sup>2</sup>**

A principle governing the distribution of current in systems of linear conductors. Frank Wenner, Proceedings of the Physical Society (London, England), vol. 39, part 2, p. 124, February 15, 1927.

Development of seismological instruments at the Bureau of Standards. Frank Wenner, Bulletin, Seismological Society of America (Stanford, Calif.), vol. 22, No. 1, March, 1932.

The determination of the electrical units by mechanical measurements. H. L. Curtis, Journal, Washington Academy of Sciences (Washington, D. C.), vol. 22, p. 193, April 19, 1932.

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<sup>2</sup> Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 25 cents per year (United States and its possessions, Canada, Cuba, Mexico, Newfoundland, and Republic of Panama); other countries, 40 cents. Subscription to Journal of Research, \$3 per year; other countries, \$3.75. Subscription to Commercial Standards Monthly, \$1 per year; other countries, \$1.25.

<sup>3</sup> "Letter circulars" are in mimeographed form and are designed primarily to answer specific inquiries. The supply is necessarily limited so that, in general, but 1 copy can be sent in answer to each request. Copies are available only on application to the Bureau of Standards, Washington, D. C. No mailing list is maintained for "letter circulars" and complete sets of back numbers can not be furnished.

<sup>4</sup> "Outside publications" are not for distribution or sale by the Government, unless otherwise noted. Requests should be sent direct to publishers.

- Electrochemistry in electrical engineering. G. W. Vinal, *Electrical Engineering* (Am. Inst. of Electrical Engineers, New York, N. Y.), vol. 51, p. 238, April, 1932.
- Fire-arms identification. Wilmer Souder, *Army and Navy Journal* (Washington, D. C.), vol. 69, No. 29, p. 675, March 19, 1932.
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- The following articles were published in the United States Daily (Washington, D. C.):
- H. S. Rawdon:
- Finding practical uses for nonferrous metals, vol. 7, No. 40, p. 8, April 19, 1932.
  - Spectrochemical tests of nonferrous metals, vol. 7, No. 41, p. 8, April 20, 1932.
  - Studies of properties of nonferrous metals, vol. 7, No. 42, p. 8, April 21, 1932.
  - Determining use values of nonferrous metals, vol. 7, No. 43, p. 8, April 22, 1932.
  - Utilizing excess output of nonferrous metals, vol. 7, No. 44, p. 8, April 23, 1932.
  - Standardizing products of nonferrous metals, vol. 7, No. 45, p. 8, April 25, 1932.
- E. W. Ely:
- Applying specifications to nonferrous products, vol. 7, No. 46, p. 8, April 26, 1932.
  - Eliminating unnecessary nonferrous products, vol. 7, No. 47, p. 8, April 27, 1932.

